



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Equipement de l'Aviation Civile

**FUTURE AIR NAVIGATION SYSTEM 1/A —
AERONAUTICAL TELECOMMUNICATION NETWORK
INTEROPERABILITY STANDARD
(FANS 1/A — ATN B1 INTEROP STANDARD)**

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ED-154A

March 2012

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FOREWORD

1. ED-154 was prepared jointly by EUROCAE Working Group 53 and RTCA Special Committee 189, was approved by the Council of EUROCAE on 3 July 2008.
2. ED-154A was prepared jointly by EUROCAE Working Group 78 and RTCA Special Committee 214, was approved by the Council of EUROCAE on 8 March 2012.
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CHAPTER 1

INTRODUCTION

This standard was developed to enable air traffic service providers (ATSPs) to interoperate with data link equipped aircraft, regardless of which technology is installed on the aircraft. The standard is intended to support the goal of converging oceanic and continental data link applications.

1.1 PURPOSE

This document provides the interoperability requirements for an aeronautical telecommunication network baseline 1 (ATN B1) ground system that provides air traffic data link services to future air navigation system 1/A (FANS 1/A) aircraft in continental airspace.

NOTE: *Based on ED-78A/DO-264, INTEROP and SPR standards provide recommendations intended for government organizations, conference of governments, or agencies having statutory jurisdiction over the use and provision of air traffic services supported by data communications. These recommendations are for use by such government organizations to enunciate official policy, related to such matters, in aeronautical information publications (AIPs), notices to airmen (NOTAMS), airplane flight manuals (AFMs), and operator specifications.*

1.2 SCOPE

This standard provides:

- a) Interoperability requirements for the ATN B1 ground system to provide FANS 1/A aircraft data link services, as defined by the Continental SPR Standard. See [paragraph 1.2.1](#).
- b) Interoperability requirements to ensure seamless transition of ATS communications for bilingual aircraft (i.e. aircraft equipped with FANS 1/A and ATN B1 data link technologies) transitions from a FANS 1/A ground system to an ATN B1 ground system or vice versa (e.g. FANS 1/A ground system providing data link services in an oceanic airspace and an ATN B1 ground system providing data link services in a domestic airspace). See [paragraph 1.2.2](#)

NOTE 1: *This standard provides a separated set of requirements for each of these two capabilities, which can be implemented and qualified independently.*

NOTE 2: *Some ATN B1 ATSUs might elect to comply with [section 3](#) only, with [section 4](#) only or with both [section 3](#) and [section 4](#). Some FANS 1/A ATSUs might elect to comply with §4. FANS 1/A and ATN B1 bilingual aircraft might elect to comply with [section 4](#).*

1.2.1 ATN B1 Ground System Providing ATS Datalink Services to FANS1/A Aircraft

This standard provides interoperability requirements for the ATN B1 ground system to provide FANS 1/A aircraft data link services, as defined by the Continental SPR Standard, taking into consideration ICAO material listed in [paragraph 1.5](#). The following continental data link services are considered for the FANS 1/A aircraft:

- Data Link Initiation Capability (DLIC)
- ATC Communications Management (ACM)
- ATC Clearance (ACL)
- ATC Microphone Check (AMC)

This standard also considers the FANS 1/A aircraft emergency data communication capability.

- NOTE 1:** *This standard considers message elements of the CPDLC application that are included in the “version 1” message set as defined by the ATN B1 INTEROP Standard to support the ACM, ACL, and AMC data link services and the FANS 1/A aircraft emergency data communication capability. See [paragraph 3.2.2.8](#) for the uplink CPDLC message elements and [paragraph 3.2.2.9](#) for the downlink CPDLC message elements considered within the scope of this document.*
- NOTE 2:** *This standard only considers message element parameters and data types of the CPDLC application that are included in the ATN B1 INTEROP Standard for the message elements in the “version 1” message set. See [paragraph 3.2.2.12](#) for message element parameters and data types considered within the scope of this document.*
- NOTE 3:** *This standard does not consider the Departure Clearance (DCL) Service, Downstream Clearance (DSC) Service, Flight Plan Consistency (FLIPCY) Service, and Data Link – Automatic Terminal Information Service (D-ATIS), as defined in the Continental SPR Standard.*
- NOTE 4:** *General guidance for use of the Automatic Dependent Surveillance (ADS) application is provided at Appendix A.*
- NOTE 5:** *This standard does not consider the Flight Information Service application.*
- NOTE 6:** *The scope of this document has been determined based on the need at the time this standard was developed. This standard may be revised at a later time as experience is gained, and to expand the scope as the need arises to include, for example, the interoperability requirements for using ADS to provide continental data link services to aircraft in a mixed technology environment, and the interoperability requirements for the FANS 1/A ground system to provide oceanic data link services to ATN aircraft.*

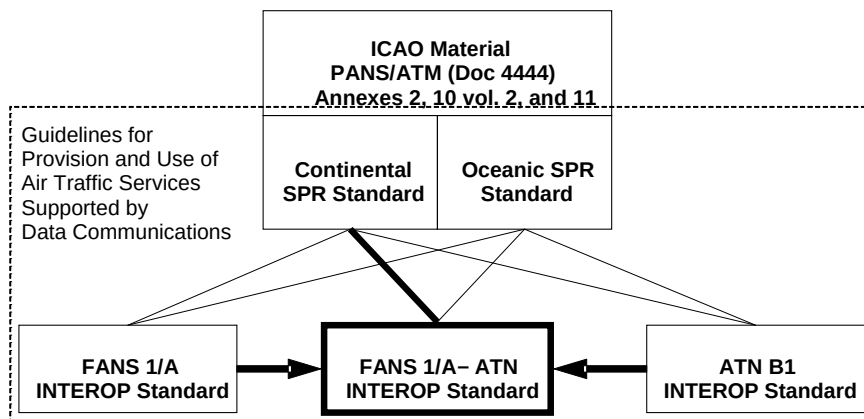
1.2.2 Ground Systems Providing ATS Datalink Services to Bilingual Aircraft

This standard also provides Interoperability Requirements to ensure seamless transition of ATS communications when a transition between two adjacent airspaces requires the aircraft to switch between different ATS datalink technologies (e.g. FANS 1/A in oceanic area vs. ATN B1 in domestic area). These requirements will apply only for aircraft claiming the capability to adapt the technology used for ATS Datalink communications in avionics according to the flown area (so called, “Bilingual aircraft”).

1.3 RELATIONSHIPS TO OTHER DOCUMENTS

[Figure 1-1](#) is used to illustrate the relationships between the standards. In addition to ICAO material, this standard is intended for use in conjunction with the following RTCA/EUROCAE documents:

- ED-120 Change 1/DO-290 Change 1, Safety and Performance Standard for air traffic data link services in continental airspace (Continental SPR Standard), which provides the definition of the term, “continental data link services,” as used in this document.
- ED-100A/DO-258A, FANS 1/A Interoperability (INTEROP) Standard, which provides the definition of the terms, “FANS 1/A aircraft” and “FANS 1/A ground system,” as used in this document.
- ED-110B/DO-280B, ATN B1 INTEROP Standard, which provides the definition of the terms, “ATN B1 ground system” and “ATN B1 aircraft,” as used in this document.
- ED-78A/DO-264, Guidelines for the Provision and Use of Air Traffic Services Supported by Data Communications, for provides guidance material for implementation and approval of air traffic data link services.



Based on ICAO Material/SPR standards and existing INTEROP standards

“Mixed Technology” Environments			
Airspace Type	Technology		Remarks
	Ground System	Aircraft System	
Continental	ATN B1	FANS 1/A	Initial Release
		FANS 1/A and ATN B1 Bilingual Aircraft	Rev A
Oceanic	FANS 1/A	ATN B1	Not considered
		FANS 1/A and ATN B1 Bilingual Aircraft	Rev A

FIGURE 1-1: MIXED TECHNOLOGY ENVIRONMENTS

This INTEROP standard is developed in accordance with the guidelines of ED-78A/DO-264 taking into account experience gained from the production of other INTEROP Standards. For the ATN B1 ground system intending to provide continental data link services to FANS 1/A aircraft, this INTEROP standard can be used as evidence of the interoperability assessment using a mixture of FANS 1/A and ATN B1 technologies.

This evidence provides the basis for qualifying implementations to the interoperability requirements for elements of the CNS/ATM system, taking into consideration the operational, safety, and performance requirements provided by the Continental SPR Standard and relevant ICAO material. It is noted that this document alone does not satisfy all the requirements for approval and implementation. For example, a specific implementation will need to ensure compliance with the operational, safety, and performance requirements, provided in the Continental SPR Standard, and other requirements stated by the appropriate regulatory authority. Applicants will have to show for approval that this INTEROP standard is viable for the relevant SPR standards as per Sections 5 and 6 of ED-78A/DO-264.

NOTE: When this INTEROP standard is recognized in AIPs, NOTAMs, AFMs, and operator's specifications, such recognition and other unique characteristics affecting interoperability for a specific air traffic service provision, aircraft type design, or operator's operation can be found in the respective documents.

1.4 DESCRIPTION OF THIS DOCUMENT

1.4.1 Document Conventions

The following conventions are used in this document:

- a) This document provides mandated criteria, i.e. the criteria are mandatory and no alternative may be applied to the ATN B1 ground system providing continental data link services to FANS 1/A aircraft. The mandated criteria take the form of interoperability requirements. Each requirement is prefaced with the nomenclature, **IR-[x]**, where [x] is a sequential number. In some cases, the word “shall” appears in a statement that was taken from another document, e.g., the ATN B1 INTEROP Standard or ICAO Doc 9705. These criteria are considered mandatory by their respective reference.

NOTE: *In an approval context, the “shalls” are considered a mandated criterion if the:*

- *Applicant defines this standard, in conjunction with relevant INTEROP standards, and any adaptation (Refer to EUROCAE ED-78A/RTCA DO-264, paragraph 1.3.3), as the approval basis, and*
- *Approval authority accepts this approval basis.*

The approval basis defines the criteria for compliance. “Shoulds” are typically used to describe guidelines for the processes used to produce elements of the system or for meeting the mandated criterion.

- b) The use of the word “should” is not used in this document in any particular context other than normal use. Text that appears in this standard that is not prefaced by **IR-[x]** can have the following meaning:
1. To aid in the understanding of the mandatory criterion or as guidance material; and
 2. In cases where “No additional interoperability requirement” is stated in a table row, no **additional** interoperability requirements are necessary for specific item described in the row. It is noted, however, that the interoperability requirements provided in the cross-referenced paragraphs for that item are applicable.
- c) This document normally refers to the Continental SPR Standard, the ATN B1 INTEROP Standard, and the FANS 1/A INTEROP Standard. In some cases, where these standards do not provide sufficient detail to describe the interoperability requirements, reference will be made to other documents. For example, in some cases direct reference is made to ICAO Doc 9705. In these cases, the reference is ICAO Doc 9705, edition 2, as modified by the resolutions to the Problem Defect Reports (PDRs) provided in the ATN B1 INTEROP Standard.

1.4.2 Document Organization

- [Section 1](#) – Provides an introduction to the Interoperability Requirements Standard for FANS-ATN systems.
- [Section 2](#) – Provides FANS-ATN system description and operational considerations.
- [Section 3](#) - Defines the procedures for ATN B1 Ground Systems providing ATS Datalink Services to FANS 1/A aircraft.
- [Section 3.1](#) – Defines the interoperability requirements for the FANS-ATN system Communication requirements.

- [Section 3.2](#) – Defines the interoperability requirements for the FANS-ATN system requirements for Data Link Applications.
- [Section 3.3](#) – Defines the interoperability requirements for the FANS-ATN system dynamic functions/operations of Data Link services.
- [Section 4](#) - Defines the procedures for ground systems providing ATS datalink services to bilingual aircraft.
- [Appendix A](#) – Provides guidance to determine the interoperability requirements needed for the ATN B1 ground system to use the ADS application with the FANS 1/A aircraft.
- [Appendix B](#) – Lists the members of EUROCAE WG-53/RTCA SC-189.
- [Appendix C](#) – Provides the history of this document and its relationship to the terms of reference of WG-53/SC-189.
- [Appendix D](#) – Is an improvement suggestion form for this document.

1.4.3

Acronyms and Glossary of Terms

The following acronyms and terms are consistent with those used in the ED-78A/DO-264, the SPR Standards, and the INTEROP Standards referenced in this document.

ACRONYMS

Acronym	Description
ACL	ATC Clearance (service)
ACM	ATC Communication Management (service)
ADS	Automatic Dependent Surveillance
AFN	ATC Facility Notification
AMC	ATC Microphone Check (service)
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATN	Aeronautical Telecommunication Network
ATS	Air Traffic Services
ATSP	Air Traffic Service Provider
ATSU	Air Traffic Service Unit
C-ATSU	Current/Controlling Air Traffic Service Unit
CDA	Current Data Authority
CM	Context Management
CNS/ATM	Communication, Navigation, and Surveillance/Air Traffic Management
CPDLC	Controller Pilot Data Link Communication
CSP	Communication Service Provider
D-ATIS	Data link Automatic Terminal Information Service
DCL	Departure Clearance (service)
DLIC	Data Link Initiation Capability (service)
DM	Downlink Message
DSC	Downstream Clearance (service)
EOBT	Estimated Off Block Time

Acronym	Description
ETD	Estimated Time of Departure
FIS	Flight Information Service
FLIPCY	Flight Plan (Route) Consistency (service)
FMS	Fight Management System
FOM	Figure Of Merit
ICAO	International Civil Aviation Organization
IMI	Imbedded Message Identifier
INTEROP Standard	Interoperability Requirement Standard
LACK	Logical Acknowledgement
LTSAP	Long Transport Service Access Point
MAS	Message Assurance
MFI	Message Format Identifier
NDA	Next Data Authority
OSD	Operational Service and Environment Description
PDU	Protocol Data Unit
R-ATSU	Receiving Air Traffic Service Unit
SMI	Standard Message Identifier
SPR Standard	Safety and Performance Requirements Standard
T-ATSU	Transferring Air Traffic Service Unit
UM	Uplink Message
VCI	Voice Contact Information
VHF	Very High Frequency
WILCO	Will Comply

GLOSSARY OF TERMS

Term	Definition
Abstract Syntax Notation One (ASN.1)	Abstract syntax notation One is defined in ISO/IEC 8824-1. The purpose of this notation is to enable data types to be defined, and values of those types specified, without determining their actual representation (encoding) for transfer by protocols. (Refer ICAO Doc 9705)
Aeronautical Telecommunication Network (ATN)	A network comprising application entities and communication services which allow ground, air-to-ground and avionics data subnetworks to interoperate by adopting common interface services and protocols based on the International Organization for Standardization (ISO) open systems interconnection (OSI) reference model. (Refer ICAO Doc 9705)
Aircraft address	A unique combination of 24 bits available for assignment to an aircraft for the purpose of air-ground communications, navigation and surveillance. (Refer ICAO Doc 4444)
Aircraft flight identification	A group of letters, figures or a combination thereof, which is either identical to, or the coded equivalent of the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground ATS communication. (Refer ICAO Doc 9705)
Aircraft identification	A group of letters, figures or a combination thereof, which is either identical to, or the coded equivalent of the aircraft call sign to be used in air-ground communications, and which is used to identify the aircraft in ground-ground ATS communication. (Refer ICAO Doc 4444)
Air Traffic Services Unit (ATSU)	A generic term meaning variously, ATC unit, flight information centre, or ATC service area control services reporting office. In this document, ATSU refers to both human operators (e.g. controllers) and automated systems (e.g. data processing systems) at an ATSU, unless specifically stated otherwise. (Refer ICAO Doc 4444)
Bilingual aircraft	An aircraft implementing both FANS 1/A (in compliance with ED-100A/DO-258A) and ATN B1 (in compliance with ED-110B/DO-280B) applications, capable of switching between the two technologies to allow seamless ATS communications transition between two adjacent ATSUs, one using FANS 1/A and the other using ATN B1.
CPDLC message	A CPDLC message that includes data for the application user to verify the integrity and the correct delivery of each individual message.
Current ATS Unit (C-ATSU)	In ACM context: The ATSU that can exchange ATC communications messages with an aircraft. (Refer the Continental SPR Standard) Controlling ATSU - The air traffic control unit exercising legal authority over the initiation, continuation, diversion or termination of flights and providing air traffic control service to controlled flights in the control area under its jurisdiction. (Refer Doc 9705)

Term	Definition
Enabled	In the context of CPDLC, refers to a connection, which has been activated for operational exchanges. To become enabled, a CPDLC connection must have CDA status in accordance with the ATN B1 INTEROP standard, or equivalent, when providing data link services to FANS 1/A aircraft, as specified in this document.
End System (ES)	A system that contains the human-machine interface, application processing, and is distinct from system components interfacing the communication services. (Refer the Continental SPR Standard) <u>Note:</u> This definition is modified from EUROCAE ED-78A/RTCA DO-264 to remove technological dependencies.
Receiving ATS Unit (R-ATSU)	In ACM context: The next ATSU that the aircraft will enter. (Refer the Continental SPR Standard) Receiving ATSU - The next air traffic control unit which is the process of accepting the control authority and communication responsibility for a flight transferred by the controlling ATSU (C-ATSU). (Refer ICAO Doc 9705)
Transferring ATS Unit (T-ATSU)	In ACM context: The ATSU that the aircraft is about to leave. (Refer the Continental SPR Standard)

1.5

REFERENCES

The references cited in this INTEROP standard are listed below:

- EUROCAE ED-78A/RTCA DO-264, Guidelines for Approval of the Provision and Use of Air Traffic Services Supported by Data Communications;
- EUROCAE ED-110B/RTCA DO-280B, Interoperability Requirements Standard for ATN Baseline 1 (ATN B1 INTEROP Standard);
- EUROCAE ED-100A/RTCA DO-258A, Interoperability Requirements Standard for FANS1/A (FANS 1/A INTEROP Standard);
- EUROCAE ED-120 Change 2/RTCA DO-290, Safety and Performance Requirements Standard for Air Traffic Data Link Services in Continental Airspace (Continental SPR Standard);
- ICAO Annex 2 — Rules of the Air;
- ICAO Annex 10 — Aeronautical Telecommunications - Volume II (Communications Procedures including those with PANS status);
- ICAO Annex 11 — Air Traffic Services;
- ICAO Doc 4444 – Procedures for Air Navigation Services – Air Traffic Management; and
- ICAO Doc 9705-AN956 Edition 2 – Manual of Technical Provisions for the Aeronautical Telecommunications Network (ATN).

CHAPTER 2

DESCRIPTION AND OPERATIONAL CONSIDERATIONS

This section provides a description and operational considerations for the ATN B1 ground system providing FANS 1/A aircraft the continental data link services as defined in the Continental SPR Standard and as limited by the scope of this document provided in [paragraph 1.2](#).

TABLE 2-1 presents a mapping between continental data link services, the ATN B1 applications, and the FANS 1/A applications. The table includes references to the paragraphs in this document that provide interoperability requirements for the ATN B1 ground system providing continental data link services to FANS 1/A aircraft.

TABLE 2-1: CONTINENTAL DATA LINK SERVICES AND APPLICATIONS

Continental Data Link Service	ATN B1 Application	FANS 1/A Application	Reference
DLIC	CM	AFN	Paragraphs 4.1 , 5.1
ACM	CPDLC	CPDLC	Paragraphs 4.2 , 5.2.1
ACL	CPDLC	CPDLC	Paragraphs 4.2 , 5.2.2
AMC	CPDLC	CPDLC	Paragraphs 4.2 , 5.2.3

The ATN B1 applications for the ground system and the aircraft are defined in terms of partial definition of the Context Management (CM) and CPDLC applications, as defined in the ATN B1 INTEROP Standard. The ATN B1 INTEROP Standard provides a mapping of these partial definitions to the continental data link services.

The FANS 1/A applications for the ground system and the aircraft are defined in terms of complete definition of the ATC Facility Notification (AFN) and CPDLC applications, as defined in the FANS 1/A INTEROP Standard. This document, [section 5](#), provides a mapping of these complete definitions to sequence of operations for the continental data link services using either the ATN B1 or FANS 1/A technology. There are many similarities even though the nomenclatures are different. Both the ATN B1 and the FANS 1/A technologies use similar methods for defining dynamic operation.

2.1 DATA LINK INITIATION CAPABILITY

The data link initiation capability is accomplished using CM by ATN B1 aircraft, and using AFN by the FANS 1/A aircraft.

2.1.1 ATN B1 CM Application

The CM application enables an ATN B1 ground system to become aware of an aircraft's data link capabilities. The CM application does not establish communication between the airborne and ground peers of data link applications; this is done by the applications themselves. ATN B1 aircraft provide the application name, address, and version number for each supported ground-initiated application. In addition, an ATN B1 ground system requires that the aircraft provide flight plan association data. This information includes the airport departure (required), airport destination (required), and the estimated time of departure (if available). The ground system responds by providing the flight identification, application name and version number for each ground-initiated application that is used to provide a continental data link service.

In addition to flight identification, application name and version number, the ATN B1 ground system provides the address information (for air-initiated applications) in the CM logon response.

The ATN B1 ground system and ATN B1 aircraft use only the CM Logon and CM Contact operational functions and the CM Abort (user and provider) functions.

2.1.2 FANS 1/A AFN Application

The ATS Facilities Notification (AFN) application enables an ATS ground system to become aware of an aircraft's data link capabilities. The AFN does not establish communications between the airborne and ground peers of data link applications; this is done by the applications themselves. Airborne systems provide the flight identification, application name and version number for each supported application. AFN consists of an AFN Contact and a Contact Advisory function.

2.2 CPDLC APPLICATION

The CPDLC application enables pilots and controllers to exchange messages via data, complementary to voice. The CPDLC application includes a set of clearance/information/request message elements that correspond to existing voice phraseology used for air traffic control.

2.2.1 ATN B1 CPDLC Application

The ATN B1 CPDLC application includes only a limited subset of the ICAO Doc 4444 CPDLC message elements.

The ATN B1 CPDLC message elements encompass level assignments, crossing constraints, route modifications and clearances, speed assignments, radio frequency assignments, and various requests for information. The pilot is provided with the capability to respond to messages, to request some types of clearances and information, and to report information. An uplink "free text" capability is also provided to exchange information not conforming to defined formats and to append information explaining error reasons. A downlink "free text" capability is also provided to only to append information explaining error reasons.

NOTE: *The ATN B1 CPDLC application does not provide the pilot the capability to declare/cancel an emergency.*

2.2.2 FANS 1/A CPDLC Application

The FANS 1/A INTEROP Standard specifies a set of message elements, similar to the defined CPDLC message elements set in Doc 4444. FANS 1/A CPDLC message elements encompass altitude assignments, crossing constraints, lateral offset deviations, route modifications and clearances, speed assignments, radio frequency assignments, and various requests for information. The pilot is provided with the capability to respond to messages, to request clearances and information, to report information, and to declare/cancel an emergency. A "free text" capability is also provided to exchange information not conforming to defined formats.

CHAPTER 3

ATN B1 GROUND SYSTEM PROVIDING ATS DATALINK SERVICES TO FANS1/A AIRCRAFT

3.1 COMMUNICATION REQUIREMENTS

This section provides interoperability requirements for the FANS 1/A communication protocols and application addressing. These requirements are additional to those provided in the FANS 1/A INTEROP Standard or the ATN B1 INTEROP Standard either specifically or by reference.

IR-1: The ATN B1 ground system shall support ACARS based Air-Ground communication protocols, as per the FANS 1/A Interoperability Standard.

IR-2: The ATN B1 ground system shall keep track of the SMI used and apply the corresponding uplink SMI (Ref [f]) for all uplinks to the FANS 1/A aircraft as shown in TABLE 3-1.

IR-3: When the FANS 1/A aircraft does not use an MFI in downlink messages, the ATN B1 ground system shall use the appropriate uplink SMI (Ref [f]) for each application as given in TABLE 3-1.

IR-4: When the FANS 1/A aircraft uses an MFI in downlink messages, the ATN B1 ground system shall use the appropriate uplink SMI (Ref [f])/MFI for each uplink message as given in TABLE 3-2 and TABLE 3-3.

The following notes apply to TABLE 3-1, TABLE 3-2, TABLE 3-3.

NOTE 1: For SMI uplink, 'x' may take the value D, L, R, or 3.

NOTE 2: For SMI downlink, 'y' may take the value L, R, or 3.

NOTE 3: For label/sub-label, 'z' may take the value 1, 2, or 3.

NOTE 4: The SMI of the AFN Contact (FN_CON) message can be used to determine the appropriate addressing method for a particular aircraft.

NOTE 5: ACARS uplink messages use a combination of label and sub-label to identify the avionics device to which the message is being sent. The communication service provider converts the Standard Message Identifier (SMI) contained in the ground-ground message to the appropriate label/sub-label (and MFI) combination to allow the avionics to route the message to the appropriate airborne end-system.

TABLE 3-1: SMI DOWNLINK AND UPLINK RELATIONSHIP FOR AFN, CPDLC AND ADS

End System Type	AFN SMI		CPDLC SMI		ADS SMI	
	Uplink	Downlink	Uplink	Downlink	Uplink	Downlink
ACARS management function (MU)	AFU	AFD	ATC	ATC	RAR	PAR
Flight management system	FMx	FMy	FMx	FMy	FMx	FMy

TABLE 3-2: VALID LABEL/SUB-LABEL/MFI/IMI/SMI COMBINATIONS FOR CPDLC AND ADS UPLINK

End System Type	CPDLC				ADS			
	Label/ Sub-label	MFI	IMI	SMI	Label/ Sub-label	MFI	IMI	SMI
ACARS management function (MU)	AA	(none)	AT1 CR1 DR1	ATC	A6	(none)	ADS	RAR
Flight management system	H1/Mz	AA	AT1 CR1 DR1	FMx	H1/Mz	A6	ADS	FMx

TABLE 3-3: VALID LABEL/SUB-LABEL/MFI/IMI/SMI COMBINATIONS FOR AFN UPLINK

End System Type	AFN			
	Label/ Sub-label	MFI	IMI	SMI
ACARS management function (MU)	A0	(none)	AFN	AFU
Flight management system	H1/Mz	A0	AFN	FMx

3.2 REQUIREMENTS FOR DATA LINK APPLICATIONS

This section provides the interoperability requirements to enable FANS 1/A applications on aircraft to use continental data link services provided by the ATN B1 ground system.

IR-5: The ATN B1 ground system shall implement an ACARS compatible system (ACS) that will enable the ACARS network to support ATS applications (ACS provides formatting/addressing, cyclic redundancy check (CRC) integrity check and bit-to-hexadecimal conversion process), as per the FANS 1/A Interoperability Standard.

3.2.1 CM/AFN Application Requirements

3.2.1.1 ATN B1 CM and FANS 1/A AFN Primitives

TABLE 3-4 lists the ATN B1 CM primitives along with the comparable FANS 1/A AFN primitives.

TABLE 3-4: ATN B1 CM AND FANS 1/A AFN PRIMITIVES

ATN B1 CM Primitives	FANS 1/A AFN Primitives	Interoperability Requirement
CM Logon Request	AFN Contact	No additional interoperability requirement.
CM Logon Response	AFN Acknowledge	No additional interoperability requirement.
CM Contact Request	AFN Contact Advisory	No additional interoperability requirement.
CM Contact Response	AFN Response + AFN Complete	IR-6: When expecting a CM Contact response, the ATN B1 ground system shall be able to process the sequence of the reception of AFN response and AFN Complete. Reception of the AFN Response followed by AFN Complete is functionally equivalent to the CM Contact Response. When the AFN Complete is received, a subsequent AFN Response can be ignored.
CM Abort	No equivalent.	The ATN B1 ground system cannot issue an abort to the FANS 1/A aircraft. Both sides may time-out.

3.2.1.2 ATN B1 and FANS 1/A Primitive Parameters

TABLE 3-5 maps ATN B1 CM primitive parameters to FANS 1/A AFN primitive parameters.

TABLE 3-5: MAPPING OF PARAMETERS INTO ATN B1 CM PRIMITIVES AND FANS 1/A AFN PRIMITIVES

ATN B1 CM Primitive Parameters	FANS 1/A AFN Primitives Parameters	Interoperability Requirement
CMLogonRequest: Facility Designation Aircraft Address (24-bit address) Logon Request Aircraft Flight Identification CM Long TSAP(Aircraft CM application address) Ground-initiated application Information (for all supported applications): Application name, Application address, Application version number Air-only-initiated application Information (for all supported applications): Application name, Application version number Facility Designation (optional) Departure Airport Destination Airport ETD (optional) Class of Communication (optional)	AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN Contact: Aircraft Position Active Flag Application Name (for all supported applications) Version Number (for all supported applications)	IR-7: The ATN B1 ground system shall use the Flight ID and the Aircraft Registration to perform the flight plan association. The FANS 1/A aircraft does not provide the Departure Airport and the Destination Airport used for the flight plan association when required. The ATN B1 ground system does not use the class of communication. The FANS 1/A aircraft does not provide the Air-only-initiated application information.

TABLE 3-5: MAPPING OF PARAMETERS INTO ATN B1 CM PRIMITIVES AND FANS 1/A AFN PRIMITIVES (CONTINUED)

ATN B1 CM Primitive Parameters	FANS 1/A AFN Primitives Parameters	Interoperability Requirement
CMLogonResponse (successful): List of Application Information: Application name Application version number Application address <i>Note: Application address is only given for air-initiated applications</i> Or	AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN Acknowledge (positive): Overall Reason Code (0) Facility Designation Optional variables: Application Name(s) Reason Code Originating ATC Centre Address (optional) Or	IR-8: The ATN B1 ground system shall generate the AFN acknowledge containing an overall reason code fixed to (0) as a successful CM logon response. The airborne system uses facility designation or the ATC centre address to associate the AFN acknowledge. The application version number cannot be provided in the AFN acknowledge. A positive AFN Acknowledgement is only sent when the ground system can support the application version number given in the AFN Contact. See paragraph 3.2.1.3 for use of name variable.
CMLogonResponse (not successful): <i>Note: In this case, the ATN B1 ground system does not provide ground application information.</i>	AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN Acknowledge (negative) Overall Reason Code (non 0) Facility Designation Optional variables: Application Name(s) Reason Code Originating ATC Centre Address	IR-9: The ATN B1 ground system shall generate the AFN acknowledge containing an overall reason code fixed to (non-0) as an unsuccessful CM logon response. In this case, the ATN B1 ground system does not provide application name variables in a negative AFN acknowledge.

TABLE 3-5: MAPPING OF PARAMETERS INTO ATN B1 CM PRIMITIVES AND FANS 1/A AFN PRIMITIVES (CONTINUED)

ATN B1 CM Primitive Parameters	FANS 1/A AFN Primitives Parameters	Interoperability Requirement
CMContactRequest: Aircraft Address Facility Designation Facility Designation (the next centre to be contacted) address (CM application address representing the next ATC centre to be contacted) Class of Communications (optional)	AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN Contact Advisory: Next Centre Address Active Flag	IR-10: When requesting a CMContactRequest, the ATN B1 ground system shall send the AFN Contact Advisory. See paragraph 3.2.1.3 for use of variables.
CMContactResponse (successful): - Response (0)	Positive indication: AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN response Reason Code (0) And: AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN Complete Next Centre Address Reason Code	IR-11: The ATN B1 ground system shall process the reception of an AFN Complete (regardless of the reason code value) as the reception of a successful CM Contact Response. The ATN B1 ground system may ignore the reception of positive AFN Response. In the FANS 1/A INTEROP Standard, the AFN Complete indicates the result of the AFN Logon with the next Centre. In the ATN B1 INTEROP Standard, a successful CM Contact Response indicates that the CM Logon has been performed without any information on the logon response. The ATN B1 ground system may ignore the next Centre address parameter contained in the AFN Complete message.

TABLE 3-5: MAPPING OF PARAMETERS INTO ATN B1 CM PRIMITIVES AND FANS 1/A AFN PRIMITIVES (CONTINUED)

ATN B1 CM Primitive Parameters	FANS 1/A AFN Primitives Parameters	Interoperability Requirement
CMContactResponse (unsuccessful): - Response (1)	Negative indication: AFN Message header: Flight ID Aircraft Registration 24-bit aircraft address (optional) <i>Note: Some aircraft may provide the 24-bit aircraft address.</i> Timestamp AFN response Reason Code (non-0)	IR-12: The ATN B1 ground system shall process the reception of a negative AFN Response like the reception of a negative CM Contact Response.

3.2.1.3 ATN B1 CM and FANS 1/A AFN Variables

TABLE 3-6 maps the ATN B1 CM variables to the comparable FANS 1/A AFN variables.

TABLE 3-6: ATN B1 CM AND FANS 1/A AFN VARIABLES

ATN B1 CM Variables	FANS 1/A AFN Variables	Interoperability Requirement
Address (LongTSAP of Next Centre)	Next Centre Address	IR-13: The ATN B1 ground system shall map the CM-address of the next ATC Centre to the next ATC Centre Address. IR-14: The ATN B1 ground system shall process the address as the Next Centre address.
No equivalent.	Originating ATC Centre address	IR-15: When providing the originating ATC centre address in the positive AFN acknowledgement, the ATN B1 ground system shall set it as the same value as the ATC centre address received in the ACARS header of the AFN Contact.

TABLE 3-6: ATN B1 CM AND FANS 1/A AFN VARIABLES (CONTINUED)

ATN B1 CM Variables	FANS 1/A AFN Variables	Interoperability Requirement
AP Address	No equivalent.	No additional interoperability requirement. Information is available in the ACARS Header. The Aircraft Registration and the SMI (representing MFI or label) and IMI serve as the application address for all applications (i.e. AFN, ADS and CPDLC).
AE Qualifier (0) (22)	AP_name ADS ATC	IR-16: The ATN B1 ground system shall process the ADS application name as an AE qualifier (0). IR-17: The ATN B1 ground system shall process the ATC application name as an AE qualifier (22).
AP Version	Vers	No additional interoperability requirement.
Aircraft Address (24-bit ICAO aircraft address)	24-bit aircraft address (optional)	No additional interoperability requirement. Some FANS 1/A aircraft may provide the 24-bit aircraft address. The 24-bit aircraft address may be used locally, but not for FANS 1/A aircraft addressing.
AircraftFlightIdentification	Flight ID	No additional interoperability requirement.
No equivalent.	Active Flag	IR-18: The ATN B1 ground system shall set the active flag to 1. Active Flag is sent, but not used.
No equivalent.	Aircraft Position	The ATN B1 ground system may use locally the aircraft position.
Class of Communications	No equivalent.	No additional interoperability requirement.
No equivalent.	Overall Reason Code	See TABLE 3-5 .
Response	Reason Code	See TABLE 3-5 .
DepartureAirport	No equivalent.	No additional interoperability requirement.
DepartureTime (Optional)	No equivalent.	No additional interoperability requirement.

TABLE 3-6: ATN B1 CM AND FANS 1/A AFN VARIABLES (CONTINUED)

ATN B1 CM Variables	FANS 1/A AFN Variables	Interoperability Requirement
DestinationAirport	No equivalent.	No additional interoperability requirement.
FacilityDesignation (in the logon request header)	ICAO Facility Designation (4 Character ICAO Code)	IR-19: The ATN B1 ground system shall use the facility designation only with size 4 using the first four letters.
FacilityDesignation (Optional in the logon request primitive)	No equivalent.	No additional interoperability requirement.
LongTSAP	No equivalent.	No additional interoperability requirement. Information is available in the ACARS Header and message Header. The Aircraft Registration and the SMI (representing MFI or label) and IMI serve as the application address for all applications (i.e. AFN, ADS, and CPDLC).
No equivalent.	Timestamp	The ATN B1 ground system may use locally the timestamp.

3.2.1.4 Timers

TABLE 3-7 lists the ATN B1 CM timer along with the comparable FANS 1/A AFN timer.

TABLE 3-7: ATN B1 CM AND FANS 1/A AFN TIMERS

ATN B1 CM Timer	FANS 1/A AFN Timer	Interoperability Requirement
tts Termination timer (sender) used to indicate the absence of a CM Logon response from the ground system in an acceptable period of time When the tts is implemented, the value for the timer shall be greater than or equal to 60 sec.	ATST1 is used by the FANS 1/A aircraft to detect the absence of the AFN_ACK in response to an AFN Contact.	No additional interoperability requirement. The ATST1 timer is an airborne timer and is functionally equivalent to the 'tts' timer. ATST1 timer is set at 10 minutes, being less stringent for the FANS 1/A aircraft than for the ATN B1 aircraft.

ATN B1 CM Timer	FANS 1/A AFN Timer	Interoperability Requirement
tts Termination timer (sender) used to indicate the absence of a CM Contact response from the aircraft in an acceptable period of time When the tts is implemented, the value for the timer shall be greater than or equal to 120 sec.	ATST2 is used to detect the absence of the AFN Response in response to an AFN Contact Advisory. When it is used, it should be set to 5mn. ATST3 is used to detect the absence of the AFN Complete in response to an AFN Contact Advisory. It is set on the reception of an AFN Response positive. When it is used, it should be set to 15mn.	IR-20: When using the 'tts' timer, the ATN B1 ground system shall set the value for 'tts' as specified in the ATN B1 INTEROP Standard, paragraph 3.2.1.1.2.1. The 'tts' timer is functionally equivalent to ATST2+ATST3. For domestic airspace, the ATN B1 value is used.

3.2.2 CPDLC Application Requirements

IR-21: The ATN B1 ground system shall have the capability to encode and decode message elements addressed to or received from the FANS 1/A aircraft following the ASN.1 definitions as given in the ATN B1 INTEROP Standard.

3.2.2.1 Time, Timestamp and Message Latency

3.2.2.1.1 Time

TABLE 3-8 presents the ATN B1 and comparable FANS 1/A CPDLC requirements for time.

TABLE 3-8: ATN B1 AND FANS 1/A CPDLC REQUIREMENTS FOR TIME SOURCE

ATN B1	FANS 1/A	Interoperability Requirement
3.3.2.1 The time used for ATN B1 messages shall be in accordance with the requirements of ICAO Annex 2 for the aircraft and Annex 11 for the ATS provider.	4.6.3.3 b). All downlink CPDLC messages shall contain the timestamp which indicates the originators send time and should use a time source which is referenced to UTC. 4.6.3.3 c). All uplink messages shall contain a timestamp which indicates the originator send time to an accuracy of +/- one second, and shall use a time source which is synchronized to UTC within one second. <i>Note: In the FANS 1/A INTEROP Standard, the timestamp synchronization to UTC is a recommendation, but at the writing of this document it is assumed that the majority of aircraft are compliant to ICAO Annex 2.</i>	IR-22: The ATN B1 ground system shall only accept the FANS 1/A aircraft that follows the requirements of ICAO-Annex 2. (See the Note in column 2). IR-23: RESERVED Uplink CPDLC messages are functionally identical.

3.2.2.1.2 Timestamp Generation

TABLE 3-9 presents the ATN B1 and comparable FANS 1/A CPDLC requirements for timestamp generation.

TABLE 3-9: ATN B1 AND FANS 1/A CPDLC REQUIREMENTS FOR TIMESTAMP GENERATION

ATN B1	FANS 1/A	Interoperability Requirement
3.3.3.1 First sentence: CPDLC messages shall be timestamped.	4.6.3.3. b) All downlink CPDLC messages shall contain a timestamp which indicates the originator's send time and should use a time source which is referenced to UTC.	No additional interoperability requirement.
3.3.3.2 The timestamp shall indicate the time that the message is released by the controller, by the pilot, or by a system without human intervention, for onward transmission. <i>Note 1: When the pilot or controller sends a CPDLC message, the timestamp will be the time at which he/she authorizes the transmission of the CPDLC message (e.g. by pressing an "ENTER" key or by activation of a message release function in an interactive display).</i> <i>Note 2: For CPDLC messages generated by a system without human intervention, the timestamp will be the time when the CPDLC application releases the completed CPDLC message to the communications system.</i>	No requirement contained in the FANS 1/A INTEROP Standard.	No additional interoperability requirement. ATN B1 ground system implementers must be aware that the FANS 1/A aircraft may generate the timestamp according to local requirements.

3.2.2.1.3 Message Latency

TABLE 3-10 presents the ATN B1 and comparable FANS 1/A CPDLC requirements for message latency.

TABLE 3-10: ATN B1 AND FANS 1/A CPDLC REQUIREMENTS FOR MESSAGE LATENCY

ATN B1	FANS 1/A	Interoperability Requirement
Aircraft requirements 3.3.4.1 For aircraft systems, received CPDLC messages timestamped with a value indicating a difference between the timestamp and reception time of more than 40 seconds shall be either: discarded and notified to the originator with an ERROR message, or be presented to the pilot with the appropriate indication.	Aircraft requirements 4.6.6.9 Message Latency a. When a CPDLC timestamp is present in a received message, and the difference between the timestamp and UTC exceeds the “late message” value, the aircraft shall either provide an applicable notification to the aircrew or discard the message and notify the originator with an ERROR + FREE TEXT message. The [errorinformation] contained in such an ERROR message shall be assigned a value of “invalidData”.	IR-24: The ATN B1 ground system shall decode ErrorInformation value (10) + FREETEXT from the FANS 1/A aircraft, which is represented by ErrorInformation (3) +FREE TEXT in the ATN B1 INTEROP Standard. When processing the Urgency and/or Alert attributes, the ATN B1 ground system must take care of the differences between the FANS 1/A INTEROP Standard and ATN B1 INTEROP Standard definitions; DM62 (URG U, Alert L) in the FANS 1/A aircraft and DM67 (no attribute) in the ATN B1 ground system. See also paragraph 3.2.2.4 about message attributes.
3.3.4.1.1 When the airborne system discards a received CPDLC message because it contains a timestamp that is older than the allowed limit, it shall send a CPDLC downlink message containing the concatenation of message element DM62 (ERROR (error information)) with the choice (2) followed by message element DM98 (UPLINK DELAYED IN NETWORK AND REJECTED. RESEND OR CONTACT BY VOICE).	b. In aircraft that reject a late uplink message and send an ERROR response, the avionics shall add free text DM67 containing the text “UPLINK DELAYED IN NETWORK AND REJECTED - RESEND OR CONTACT BY VOICE” to the ERROR response.	No additional interoperability requirement.
3.3.4.1.2 When the airborne system receives a CPDLC message with timestamp that indicates a future time greater than 2 seconds from the current time, it shall send a CPDLC downlink message containing the concatenation of message element DM62 (ERROR (error information)) with the choice (2) followed by message element DM98 (UPLINK TIMESTAMP INDICATES FUTURE TIME).	No equivalent. c. Prior to the establishment of the first CPDLC connection during any flight, the “late message” value shall be set to a default value or the latency check shall be cancelled. The message latency value shall be cancelled or reset to the default value no later than at the end of the flight, and may be cancelled or reset at the end of any CPDLC connection.	No additional interoperability requirement. The FANS 1/A aircraft does not detect timestamps with a value greater than 2 seconds from the reception time.

ATN B1	FANS 1/A	Interoperability Requirement
	The aircraft shall provide a capability to modify the “late message” value during flight. <i>Note: This statement is not intended to preclude automated reset of the “late message” value, based on e.g. ground uplinks or database values.</i> d. (see ground requirements)	
Ground Requirements 3.3.4.1.3 Recommendation. For the ground system, received CPDLC messages timestamped with a value indicating a difference between the timestamp and reception of more than 40 seconds should be either: - discarded and notified to the originator with an ERROR message; or - presented with the timestamp to the controller. 3.3.4.1.4 When the ground system discards a received CPDLC message because it contains a timestamp that is older than the allowed limit, it shall send a CPDLC uplink message containing the concatenation of message element or UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 (DOWNLINK DELAYED – USE VOICE). 3.3.4.1.5 When the ground system receives a CPDLC message with timestamp that indicates a future time greater than 2 seconds from the current time, it shall send a CPDLC uplink message containing the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 (DOWNLINK TIMESTAMP INDICATES FUTURE TIME).	Ground requirements d. When a ground system enables a CPDLC connection with an aircraft, the ground system shall uplink CPDLC message UM169[SET MAX UPLINK DELAY VALUE TO XXX SEC], XXX being the “late message” value expressed in seconds. <i>Note 1: “Enabling” a CPDLC connection refers to the point at which a ground system makes the CPDLC connection available for operational exchanges. It is based on automated restrictions in the ATSU that ensure operational CPDLC messages are only sent to an aircraft under the operational control of one of its ATC sectors. The UM169 message needs to be sent after the “enabling” point to reduce the risk that the message is routinely rejected by the avionics because the transmitting ground system is not yet the CDA for that aircraft at the time the system is designed to send it.</i> <i>Note 2: Uplink of the um169 late value confirmation message needs to take place any time a new link is ‘enabled’. The ground system therefore needs to include the uplink in the case of reconnection logic for re-establishing lost CPDLC connections, etc.</i> <i>Note 3: Treatment of the subsequent DM3 (‘ROGER’) response to the UM169 is a local matter.</i>	IR-25: The ATN B1 ground system shall generate the FANS 1/A UM169 message element, [SET MAX UPLINK DELAY VALUE TO 40 SEC]. Setting and handling of the timers and handling of the Response are a local matter. The ATN B1 ground system sets the max uplink delay value as specified in the ATN B1 INTEROP Standard, paragraph 3.3.4.1.3. The free text message element UM183 is not in the FANS message set. See paragraph 3.2.2.8 for use of free text message element.

3.2.2.2 ATN B1 CPDLC Constructs and FANS 1/A ACARS IMIs

TABLE 3-11 presents the ATN B1 CPDLC constructs and comparable FANS 1/A ACARS IMIs.

TABLE 3-11: ATN B1 CPDLC CONSTRUCTS AND FANS 1/A CPDLC ACARS IMIS

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
CPDLC-start service (req/ind) (no UM included) From 3.3.5.4.1.1.1 <i>Note 1: Airborne invocation of the CPDLC-start service is considered out of scope in the ATN B1 INTEROP Standard.</i> <i>The ATN B1 ground system is not permitted to provide the CPDLC message in the CPDLC-start service (3.3.5.4.2.1)</i>	IMI CR1 UM163 [icaofacilitydesignation] [tp4table] From 4.6.2.1 <i>Note 1: Only the ATS provider system can initiate connections.</i> <i>Note 2: A valid tp4table must be supplied although ATCComm ignores it.</i>	IR-26: When establishing a CPDLC connection, the ATN B1 ground system shall send an IMI CR1 including FANS 1/A message element UM163. The ASN1 definition of UM163 is different in the ATN B1 INTEROP Standard and the FANS 1/A INTEROP Standard. See this document, paragraph 3.2.2 , for general requirements. The value for the [tp4table] parameter should be set to enumerated 0 or 1 by the ATN B1 ground system. The FANS 1/A aircraft will reject the connection initiation if no or another message element other than UM163 is contained.
CPDLC-start service (rsp/cnf)	IMI CC1 DM73 [versionnumber] Or IMI DR1 DM62 (optional) Or IMI DR1 DM64 (optional)	IR-27: The ATN B1 ground system shall convert IMI CC1 into a positive CPDLC-start confirm IR-28: The ATN B1 ground system shall not provide data link services to FANS 1/A aircraft responding with a version number other than 1. IR-29: The ATN B1 ground system shall convert the IMI DR1 received in response to the IMI CR1 into a CPDLC-start confirm (rejected), except if the DM62 error information, received with DR1, contains the value (invalid data) or (insufficient data). IR-30: When receiving an IMI DR1 containing the message element DM64 in response to the IMI CR1, the ATN B1 ground system shall convert the FANS 1/A response into a CPDLC-start Confirmation (rejected), setting the Reject Reason parameter to a CPDLC message with the ATN B1 message element DM107 (NOT AUTHORISED NEXT DATA AUTHORITY).

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
		The FANS 1/A aircraft sends the same version number 1. When it has no CPDLC connection established yet, the FANS 1/A aircraft rejects a valid CPDLC connection request if no successful logon has been done before with the ground system having sent the CPDLC connection request. When it has a CPDLC connection established, the FANS 1/A aircraft rejects a valid CPDLC connection request, if it is not coming from the ground system indicated to be the R-ATSU.
CPDLC-message service (any UM or DM)	IMI AT1 (any DM or UM) 4.6.2.1.1 If no connection is established or in the process of being established, upon receipt of any CPDLC message, the ATS Provider system shall ignore that message. 4.6.2.1.2 If a "Connect Request" (IMI=CR1) is pending, upon receipt of a message other than the corresponding "Connect Confirm" (IMI=CC1) or a "Disconnect Request" (IMI=DR1), the ATS Provider system shall ignore that message.	IR-31: If no connection is established or in the process of being established, upon receipt of any CPDLC message, the ATN B1 ground system shall ignore that message. IR-32: If a "Connect Request" (IMI=CR1) is pending, upon receipt of a message other than the corresponding "Connect Confirm" (IMI=CC1) or a "Disconnect Request" (IMI=DR1), the ATN B1 ground system shall ignore that message.
CPDLC-end service (req/ind) (UM optional) <i>Note: As per paragraph 3.2.3, UM message concatenated with CPDLC-end service in several ACM cases.</i>	IMI AT1 UM161 END SERVICE + UM (optional) <i>Note: See requirements in 4.6.2.2.1 and 4.6.2.2.2.</i>	IR-33: When ending a CPDLC connection, the ATN B1 ground system shall send IMI AT1 UM161 END SERVICE + UM (optional) to the FANS 1/A aircraft. When including a message in a CPDLC Termination Request, the ATN B1 ground system will only use UM117 or UM120 and UM135. For sending to the FANS 1/A aircraft, these optional message elements will be concatenated with UM161 message element.
CPDLC-end service (rsp/cnf) (UM optional) <i>Note: As per paragraph 3.2.3, UM message concatenated with CPDLC-end service in several ACM cases.</i>	IMI DR1 <i>Note: See requirements in 4.6.2.2.1 and 4.6.2.2.2.</i>	IR-34: When the IMI DR1 is received as response to single element message containing UM161, the ATN B1 ground system shall process it as a CPDLC-end-confirm (accepted). IR-35: Upon receipt of DM62 in the Disconnect Request, the ATN B1 ground system shall not present the message to controllers.

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
		IR-36: When the IMI DR1 is received as a response to an uplink message, containing UM161 message element, if a DM62 is included in the Disconnect Request, the ATN B1 ground system shall ignore the [errorinformation]. IR-37: When the IMI DR1 is received as response to a multiple-element message containing UM161 and UM117 or UM120, the ATN B1 ground system shall process it as a CPDLC-end-confirm (accepted). IR-38: The ATN B1 ground system shall process the operational response(s) received prior to the IMI DR1. IR-39: When a DM1 is received prior to the IMI DR1 in response to a multiple-element message containing UM161 and UM117 or UM120, the ATN B1 ground system shall process it as a CPDLC-end-confirm (rejected). The ATN B1 ground system should not process the IMI DR1 before the reception of the operational response(s) unless the dialogue timers expire. In case that there are pending uplink messages (see definition of pending uplink message in the FANS 1/A INTEROP Standard, paragraph 4.6.6.4), when the aircraft receives the end service message, the FANS 1/A aircraft generates a disconnect request containing DM62, regardless of whether or not the END SERVICE is concatenated with another message element. If negative answer is selected by the crew to the concatenated UM161 and UM117 or UM120, no subsequent IMI DR1 will be sent by the FANS 1/A aircraft. See paragraph 3.2.2.10.2 for the operational response(s) to the concatenations of UM161 and UM117 or UM120.

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
Ground CPDLC-user-abort service (CPDLCUserAbort) Including commanded termination	4.6.2.2.2 a) If an END SERVICE (uM161) message element is received as a component of a multiple element message and a WILCO (dM0) response is not a valid response for that message, send "Disconnect Request" (IMI=DR1) containing a message with the ERROR [errorinformation] (dM62) message element with the [endServiceWithNoValidResponse] value for all connections and discard the message. <i>Note: This procedure should be used by the current ATC Data Authority to invoke an abnormal connection termination. The END SERVICE (uM161) message element will be sent in combination with the ERROR [errorinformation] (uM159) message element (a combination for which WILCO (dM0) is not a valid response). The suggested [errorinformation] value is commandedTermination.</i>	IR-40: When aborting a CPDLC connection, the ATN B1 ground system shall send IMI AT1 UM161 END SERVICE concatenated with UM159 (ERROR) with error information set to 'commanded-termination'. IR-41: When DM62 is received in the Disconnect Request, the ATN B1 ground system shall not present the message to controllers. IR-42: When the IMI DR1 and included DM62 are received as response to UM161 +UM159, the ATN B1 ground system shall ignore the message. As per the FANS 1/A INTEROP Standard, paragraph 4.6.2.2.2, such a combination is processed as an abnormal disconnection. The FANS 1/A INTEROP Standard, paragraph 5.3.1.2, explains why uplink IMI DR1 should not be used to disconnect.
Air CPDLC-user-abort service (CPDLCUserAbort)	IMI DR1 Or IMI DR1 DM62 ERROR [errorinformation] Or IMI AT1 DM62 ERROR (duplicateMsgIdentificationNumber)	IR-43: When the IMI DR1 is received unsolicited, ATN B1 ground system shall process it like an Air CPDLC-user-abort (undefined). IR-44: Upon receipt of DM62 in the Disconnect Request, the ATN B1 ground system shall not present the message to controllers. IR-45: When receiving an IMI AT1 DM62 (duplicateMsgIdentificationNumber), the ATN B1 ground system shall send IMI AT1 UM161 END SERVICE concatenated with UM159 (ERROR), with error information set to 'commanded-termination', and internally process the IMI AT1 DM62 as an Air CPDLC User Abort (duplicate message identification numbers (2)). DR1 is considered unsolicited when it is received while no ground-initiated CPDLC start, end, or abort is in progress. As per Ground CPDLC-user-abort service (CPDLCUserAbort) the response to UM161 + UM159 is ignored by the ground system.

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
CPDLC-provider-abort-service (CPDLCProviderAbort) initiated by the aircraft Doc 9705, 2.3.5.4.3.1 If the User Data parameter of a D-END confirmation with Result parameter set to the abstract value “rejected”, or if the User Data parameter of a D-START indication, a D-DATA indication, or a D-END indication, does not contain a valid PDU, the CPDLC- air-ASE shall: ... b) Create an AircraftPDUs APDU with a CPDLCProviderAbortReason [invalid-PDU] APDU message element, c) Invoke D-ABORT request with: 1) the abstract value “provider” as the D-ABORT Originator parameter value, and 2) the APDU as the D-ABORT User Data parameter value,”	A DR1 DM62 (invalid data) is sent by the FANS 1/A aircraft only in response to a CR1 (Connection Request) when an error is encountered in the message contained in the CR1.	IR-46: The ATN B1 ground system shall process a DR1 DM62 (invalid data) as a CPDLC Provider abort (invalid PDU). The FANS 1/A aircraft will send an ERROR (“invalid data”) but will not disconnect in the following cases: • An invalid coded user data (FANS equivalent to PDU) is found in a AT1 IMI message (ATN equivalent is a provider abort); • An error is found during the processing at application level (ATN equivalent also an ERROR). The ATN B1 ground system will process the error (invalid data) received in IMI AT1 like a CPDLC error message and consequently remains connected. Refer to paragraph 3.2.2.11 for ERROR processing.
Doc 9705, 2.3.5.4.7.1 If the User Data parameter of a D-START indication or D-DATA indication does not contain a PDU, the CPDLC- or air-ASE shall: ... b) Create an AircraftPDUs APDU with a CPDLCProviderAbortReason [expected-PDU missing] APDU message element, c) Invoke D-ABORT request with: 1) the abstract value “provider” as the D-ABORT Originator parameter value, and 2) the APDU as the D-ABORT User Data parameter value”,	IMI DR1 DM62 (insufficient data) is sent by the FANS 1/A aircraft when insufficient data is received within a IMI CR1 to decode the included message. The FANS 1/A aircraft will downlink IMI AT1 DM62 (insufficient data) when an uplink AT1 is not correct and for the FANS 1/A aircraft in the following case: ATCComm receives an uplink message (IMI AT1) containing a [routeclearance] parameter and in the [routeinformationadditional] parameter the optional [waypointspeedaltitude] type with neither a [speed] type nor an [aTWaltitude] type.	IR-47: The ATN B1 ground system shall process IMI DR1 DM62 (insufficient data) received in response to a IMI CR1 as a provider-abort (invalid PDU). IR-48: The ATN B1 ground system shall process IMI AT1 (insufficient data) as a provider-abort (invalid PDU). When the FANS 1/A aircraft receives an uplink message (IMI AT1) containing a [routeclearance] parameter and in the [routeinformationadditional] parameter the optional [waypointspeedaltitude] type with neither a [speed] type nor an [aTWaltitude] type they also respond with IMI AT1 (insufficient data). This case is not an issue as this data combination is not within the scope of this document provided in paragraph 1.2.

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
CPDLC-provider-abort-service (CPDLCProviderAbort) initiated by the ground Doc 9705, 2.3.5.6.1.1 If a CPDLC-ground ASE detects that a timer has expired, that CPDLC- ground ASE shall: ... b) Create a GroundPDUs APDU with a CPDLCProviderAbortReason [timer-expired] APDU message element, c) Invoke D-ABORT request with: 1) the abstract value "provider" as the D-ABORT Originator parameter value, and 2) the APDU as the D-ABORT User Data parameter value	No equivalent.	IR-49: When the timer expires, the ATN B1 ground system shall abort the CPDLC connection, sending UM161 END SERVICE concatenated with UM159 (ERROR) with error information 'commanded termination' to the FANS 1/A aircraft. IR-50: The ATN B1 ground system shall ignore the DR1 that will be received in response from the aircraft. IR-51: The ATN B1 ground system shall issue a provider abort indication to the local ground user.
Doc 9705, 2.3.5.6.3.1 If the User Data parameter of a D-END confirmation with Result parameter set to the abstract value "rejected", a D-START indication, a D-DATA indication, or a D-END indication, does not contain a valid PDU, the CPDLC-ground-ASE shall: ... b) Create a GroundPDUs APDU with a CPDLCProviderAbortReason [invalid-PDU] APDU message element, c) Invoke D-ABORT request with: 1) the abstract value "provider" as the D-ABORT Originator parameter value, and 2) the APDU as the D-ABORT User Data parameter value,...	No equivalent.	When invalid coded data is detected in a IMI AT1, the ATN B1 ground system should respond with UM159 (ERROR) with error information 'invalid data.'

ATN B1 Constructs	FANS 1/A ACARS IMIs	Interoperability Requirement
No equivalent.	IMI CC1 with invalid encoded user data	When invalid coded data is detected in a IMI CC1, the ATN B1 ground system should abort the connection with UM161 concatenated with UM159 (ERROR) with error information, 'invalid data.'
Doc 9705, 2.3.5.6.7.1 If the User Data parameter of a D-START indication or a D-DATA indication does not contain a PDU, the CPDLC-ground-ASE shall: ... d) If the CPDLC-ground-user is an active user, invoke CPDLC-provider-abort service indication with the abstract value "not-permitted PDU" as the CPDLC-provider-abort Reason parameter value.	IMI AT1 without user data	When no user data is detected in a IMI AT1, the ATN B1 ground system should respond UM159 (ERROR) with error information 'insufficient data.'
No equivalent.	Unexpected IMI	When any IMI is received whilst no connection is established or in the process of being established, the ATN B1 ground system should disregard the message.

3.2.2.3 High-Level Data Structures

TABLE 3-12 compares the ATN B1 CPDLC and FANS 1/A high-level data structures.

TABLE 3-12: ATN B1 AND FANS 1/A CPDLC HIGH-LEVEL DATA STRUCTURES

ATN B1	FANS 1/A	Interoperability Requirement
Applicable GroundPDUs: CPDLCUserAbortReason CPDLCProviderAbortReason ProtectedUplinkMessage	ATCuplinkmessage	No additional interoperability requirement. The FANS 1/A aircraft does not have the user or provider abort PDUs. The FANS 1/A error reason codes support some of the ATN B1 aborts. The ATN B1 aborts and comparable FANS 1/A error reasons are shown in paragraph 3.2.3.2.1. In both the ATN B1 INTEROP Standard and the FANS 1/A INTEROP Standard, the ATC Uplink Message PDU contains the uplink message elements choices. These are compared in detail below.
Applicable AircraftPDUs: CPDLCUserAbortReason CPDLCProviderAbortReason ProtectedDownlinklinkMessage	ATCdownlinkmessage	No additional interoperability requirement. The FANS 1/A aircraft does not have the user or provider abort PDUs. The FANS 1/A error reason codes support some of the ATN B1 aborts. ATN B1 aborts and comparable FANS 1/A error reasons are shown in paragraph 3.2.3.2.1. In both the ATN B1 INTEROP Standard and the FANS 1/A INTEROP Standard the ATC Downlink Message PDU contains the downlink message elements choices. These are compared in detail below.

3.2.2.4 Message Attributes

In both the ATN B1 system and the FANS 1/A system only the response attribute is currently a requirement. Thus the following table considers only the differences for that attribute. The Urgency, Alert, and Recall attributes are not considered. For some CPDLC messages, the response attribute has actually changed between the ATN B1 message elements and the FANS 1/A message elements.

TABLE 3-13 compares the ATN B1 CPDLC and FANS 1/A uplink and downlink message response attributes.

TABLE 3-13: ATN B1 AND FANS 1/A CPDLC MESSAGE RESPONSE ATTRIBUTES

ATN B1 Message Attributes	FANS 1/A Message Attributes	Interoperability Requirement
Response Attribute - Uplink	Response Attribute - Uplink	
W/U	W/U	No additional interoperability requirement.
A/N	A/N	No additional interoperability requirement.
R	R	No additional interoperability requirement. If a ATN B1 ground system uses a message element with R response attribute, a procedure should be established to ensure that the pilot can express rejection of the message by voice and that the controller will not be mislead by the ROGER received. ATN B1 systems also permit UNABLE response message to R messages. An UNABLE response to R messages is not available in FANS 1/A. See paragraph 3.2.2.8, for use of messages with R response.

**TABLE 3-13: ATN B1 AND FANS 1/A CPDLC MESSAGE RESPONSE ATTRIBUTES
(CONTINUED)**

ATN B1 Message Attributes		FANS 1/A Message Attributes		Interoperability Requirement
Response Downlink	Attribute -	Response Downlink	Attribute -	
N	<i>Note:</i> In the ATN B1 INTEROP Standard, when a message with a N response attribute is received and an error is detected then: - If the message requires a logical acknowledgement, an ERROR response is sent with a message reference number (the same as the FANS 1/A message without the logical acknowledgement). - If the message does not permit a logical acknowledgement, then an ERROR message can be sent, but a reference number is normally not included (exception see note below). Thus the ERROR message will normally not explicitly refer to the message in error. From the ATN B1 INTEROP Standard, <u>paragraph 3.3.7.4.2</u> <u>Note 3:</u> Some aircraft always include a reference number matching the identification number of the CPDLC message to which the ERROR message refers. This is not Doc 9705 compliant when the CPDLC message in error has an "N" response attribute and does not require a LACK.	NE	<i>Note:</i> In the FANS 1/A INTEROP Standard, when a message with a NE response attribute is received and an error is detected, an ERROR response is sent that may contain a message reference number.	IR-52: The ATN B1 ground system shall be capable of accepting message reference numbers in all ERROR messages.
Y		Y		No additional interoperability requirement.

**TABLE 3-13: ATN B1 AND FANS 1/A CPDLC MESSAGE RESPONSE ATTRIBUTES
(CONTINUED)**

ATN B1 Message Attributes	FANS 1/A Attributes	Message	Interoperability Requirement
Y	Y		No additional interoperability requirement.
N	N		No additional interoperability requirement.

3.2.2.5 LACK

A “LACK required” indication is not available in the FANS 1/A INTEROP Standard definitions. Logical acknowledgements (LACKs) are not available in the FANS 1/A aircraft.

NOTE: *As LACKs are not supported by FANS 1/A aircraft, it is not necessary for an ATN B1 ground system that does not support LACK, to send UM233 USE OF LACK PROHIBITED to FANS 1/A aircraft.” (see paragraph 3.2.2.8).*

3.2.2.5.1 LACK on Downlink Messages

IR-53: The ATN B1 ground system shall not generate LACK message elements to the FANS 1/A aircraft in response to downlink messages.

3.2.2.5.2 LACK on Uplink Messages

NOTE: *The FANS 1/A aircraft transmits a Message Assurance (MA) to the ground system by the data link service provider (DSP) when the FANS 1/A aircraft has confirmed to the DSP receipt of the entire message. This confirmation is generated prior to CRC and application level message checking.*

The MA is sent for every uplink FANS 1/A message for which a confirmation is received.

IR-54: When sending a message to the FANS 1/A aircraft, the ATN B1 ground system shall translate the positive MA into a CPDLC downlink message containing the message element DM100 (LACK) using the uplink message number as message reference number.

NOTE 1: *When sending a message to the FANS 1/A aircraft, the ATN B1 ground system should translate a negative MA into a CPDLC downlink message containing the concatenation of message element DM62 (ERROR (error information)) with the choice (0) followed by message element DM98 (LOGICAL ACKNOWLEDGEMENT NOT ACCEPTED) using the uplink message number as message reference number.*

NOTE 2: *The FANS 1/A aircraft may transmit a MA followed by an ERROR response for the same uplink message.*

NOTE 3: *As per IR-52: the ATN B1 ground system is capable of accepting message reference numbers in all ERROR messages.*

3.2.2.6 CPDLC Disabling/Enabling

TABLE 3-14 presents the interoperability requirements for CPDLC disabling/enabling functionality available in the ATN B1 ground system.

TABLE 3-14: INTEROPERABILITY REQUIREMENTS FOR CPDLC DISABLING/ENABLING FUNCTIONALITY AVAILABLE IN THE ATN B1 GROUND SYSTEM

ATN B1	FANS 1/A	Interoperability Requirement
3.3.7.2 <i>Note: Some ATN B1 ground systems allow CPDLC to be turned "ON" and "OFF" on an ATSU and/or sector basis. When this is done for a whole ATSU, the CPDLC connection is terminated on an aircraft by aircraft basis as dialogues are completed. When this is done on a sector basis the CPDLC connection is maintained. This capability may be used at any time.</i>	No equivalent.	No additional interoperability requirement. As per the FANS 1/A INTEROP Standard, paragraph 4.6.2.2, when CPDLC has been disabled for the whole ATSU, the FANS 1/A ground system sends IMI AT1 UM161 END SERVICE concatenated with UM159 (ERROR) with error information 'commanded-termination' to all FANS 1/A aircraft currently connected.
3.3.7.2.1 When an ATSU/sector sets CPDLC to "OFF", the ground system shall send a CPDLC message containing the message element UM183 (CPDLC NOT IN USE. VOICE ONLY UNTIL NOTIFIED).	No equivalent.	No additional interoperability requirement.

TABLE 3-14: INTEROPERABILITY REQUIREMENTS FOR CPDLC DISABLING/ENABLING FUNCTIONALITY AVAILABLE IN THE ATN B1 GROUND SYSTEM (CONTINUED)

ATN B1	FANS 1/A	Interoperability Requirement
3.3.7.2.2 When a sector sets CPDLC to “ON”, the ground system shall send a CPDLC message containing the message element UM183 (CPDLC NOW IN USE).	No equivalent.	No additional interoperability requirement. See paragraph 3.2.2.8 for use of free text to provide the functionality of UM183.
3.3.7.2.3 After a sector has sent a CPDLC message containing the message element UM183 (CPDLC NOW IN USE), it shall send another CPDLC message containing message element UM183 (freetext) containing facility designation, facility name and facility function as defined in 3.3.7.6.2.3.	No equivalent.	No additional interoperability requirement.
3.3.7.2.4 When the ground system wants to uplink a VCI and it is known that the R-Sector/R-ATSU has CPDLC set to “OFF”, a CPDLC message shall be sent, containing the concatenation of the message element UM183 (NEXT SECTOR CPDLC NOT IN USE UNTIL NOTIFIED – USE VOICE) with the VCI uplink message.	No equivalent.	No additional interoperability requirement.
3.3.7.2.5 When the ground system receives a CPDLC message, and discards the message because CPDLC is set to “OFF”, then the ground system shall send a CPDLC uplink message containing the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 (CPDLC NOT AVAILABLE AT THISTIME – USE VOICE).	No equivalent.	No additional interoperability requirement.

TABLE 3-14: INTEROPERABILITY REQUIREMENTS FOR CPDLC DISABLING/ENABLING FUNCTIONALITY AVAILABLE IN THE ATN B1 GROUND SYSTEM (CONTINUED)

ATN B1	FANS 1/A	Interoperability Requirement
3.3.7.2.6 When the ground system receives a CPDLC message, and discards the message because the associated dialogue type is disabled, then the ground system shall send a CPDLC uplink message containing the concatenation of message element UM159 (ERROR (error information)) with the choice (2) followed by message element UM183 ((dialogue type) NOT AVAILABLE AT THIS TIME - USE VOICE). <i>Note: Some ATN B1 ground systems allow specific dialogue types to be disabled. This capability may be used at any time. See section 3.3.8.1.1 for specific dialogue types.</i>	No equivalent.	IR-55: When a downlink message is received and discarded because the associated dialogue type is disabled, the ATN B1 ground system shall generate a concatenated CPDLC uplink message containing message element UM159 (ERROR (error information)) followed by message element UM169 ((dialogue type) NOT AVAILABLE AT THIS TIME - USE VOICE), with dialogue type being one among the following texts: - "LEVEL" - "ROUTE" - "HEADING" - "SPEED" - "TIME" - "EMERGENCY" IR-56: The ATN B1 ground system shall ignore the ROGER message received in response to the UM169 message.

3.2.2.7 Message Header

TABLE 3-15 compares the ATN B1 and FANS 1/A CPDLC message headers.

TABLE 3-15: ATN B1 AND FANS 1/A CPDLC MESSAGE HEADERS

ATN B1 Message Header	FANS 1/A Message Header	Interoperability Requirement
Message Identification Number	Message Identification Number	No additional interoperability requirement.
Message Reference Number (optional)	Message Reference Number (optional)	No additional interoperability requirement.
Timestamp consisting of date (YYMMDD) and time (HHMMSS) (required)	Timestamp HHMMSS (optional) <i>Note: The optional item is always provided by the FANS 1/A aircraft.</i>	IR-57: The ATN B1 ground system shall use their own system date source. For downlink CPDLC messages, the ATN B1 ground system has to take into consideration that the date is not available in the FANS 1/A timestamp. Around midnight, the ATN B1 ground system has to receive and process time information related to the previous day. For uplink CPDLC messages, the ATN B1 ground system cannot provide the date in uplink messages addressed to the FANS 1/A aircraft.
An indication if logical acknowledgement is required	(none)	No additional interoperability requirement. See paragraph 3.2.2.5 for LACK requirements on downlink and uplink message elements.

3.2.2.8 Uplink Message Elements

TABLE 3-16 lists ATN B1 uplink message elements, the corresponding FANS 1/A uplink message elements, and related interoperability requirements.

TABLE 3-16: ATN B1 AND FANS 1/A CPDLC UPLINK MESSAGE ELEMENTS

ATN B1 Message Element	FANS 1/A Message Element	Interoperability Requirement
UM0 UNABLE	UM0 UNABLE	No additional interoperability requirement.
UM1 STANDBY	UM1 STANDBY	No additional interoperability requirement.
UM3 ROGER	UM3 ROGER	No additional interoperability requirement.
UM4 AFFIRM	UM4 AFFIRM	No additional interoperability requirement.
UM5 NEGATIVE	UM5 NEGATIVE	No additional interoperability requirement.
UM19 MAINTAIN [level]	UM19 MAINTAIN [altitude] Or UM30 MAINTAIN BLOCK [altitude] TO [altitude]	IR-58: When using a vertical range, the ATN B1 ground system shall convert the ATN B1 UM19 message element to FANS 1/A UM30 message element. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter.
UM20 CLIMB TO [level]	UM20 CLIMB TO AND MAINTAIN [altitude] Or UM31 CLIMB TO AND MAINTAIN BLOCK [altitude] TO [altitude]	IR-59: When using a vertical range, the ATN B1 ground system shall convert the ATN B1 UM20 message element to the FANS 1/A UM31 message element. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter.
UM23 DESCEND TO [level]	UM23 DESCEND TO AND MAINTAIN [altitude] Or UM32 DESCEND TO AND MAINTAIN BLOCK [altitude] TO [altitude]	IR-60: When using a vertical range, the ATN B1 ground system shall convert the ATN B1 UM23 message element to the FANS 1/A UM32 message element. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter.

ATN B1 Message Element	FANS 1/A Message Element	Interoperability Requirement
UM26 CLIMB TO REACH [level] BY [time]	UM26 CLIMB TO REACH [altitude] BY [time]	IR-61: When using a vertical range, the ATN B1 ground system shall prohibit the use of UM26 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter.
UM27 CLIMB TO REACH [level] BY [position]	UM27 CLIMB TO REACH [altitude] BY [position]	IR-62: When using a vertical range, the ATN B1 ground system shall prohibit the use of UM27 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter. See paragraph 3.2.2.12.2 for use of position parameter.
UM28 DESCEND TO REACH [level] BY [time]	UM28 DESCEND TO REACH [altitude] BY [time]	IR-63: When using a vertical range, the ATN B1 ground system shall prohibit the use of UM28 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter.
UM29 DESCEND TO REACH [level] BY [position]	UM29 DESCEND TO REACH [altitude] BY [position]	IR-64: When using a vertical range, the ATN B1 ground system shall prohibit the use of UM29 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter. See paragraph 3.2.2.12.2 for use of position parameter.
UM46 CROSS [position] AT [level]	UM46 CROSS [position] AT [altitude]	IR-65: When using a vertical range, the ATN B1 ground system shall prohibit the use of UM46 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter. See paragraph 3.2.2.12.2 for use of position parameter.

ATN B1 Message Element	FANS 1/A Message Element	Interoperability Requirement
UM47 CROSS [position] AT OR ABOVE [level]	UM47 CROSS [position] AT OR ABOVE [altitude]	IR-66: , When using a vertical range, the ATN B1 ground system shall prohibit use of UM47 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter. See paragraph 3.2.2.12.2 for use of position parameter.
UM48 CROSS [position] AT OR BELOW [level]	UM48 CROSS [position] AT OR BELOW [altitude]	IR-67: When using a vertical range, the ATN B1 ground system shall prohibit use of UM48 for the FANS 1/A aircraft. No additional interoperability requirement for single level. See paragraph 3.2.2.12.1 for use of level parameter. See paragraph 3.2.2.12.2 for use of position parameter.
UM51 CROSS [position] AT [time]	UM51 CROSS [position] AT [time]	No additional interoperability requirement. See paragraph 3.2.2.12.2 for use of position parameter.
UM52 CROSS [position] AT OR BEFORE [time]	UM52 CROSS [position] AT OR BEFORE [time]	No additional interoperability requirement. See paragraph 3.2.2.12.2 for use of position parameter.
UM53 CROSS [position] AT OR AFTER [time]	UM53 CROSS [position] AT OR AFTER [time]	No additional interoperability requirement. See paragraph 3.2.2.12.2 for use of position parameter.
UM54 CROSS [position] BETWEEN [time] AND [time]	UM54 CROSS [position] BETWEEN [time] AND [time]	No additional interoperability requirement. See paragraph 3.2.2.12.2 for use of position parameter.
UM55 CROSS [position] AT [speed]	UM55 CROSS [position] AT [speed]	No additional interoperability requirement. See paragraph 3.2.2.12.2 for use of position parameter. See paragraph 3.2.2.12.3 for use of speed parameter.